EVIDENCE OF RAPID TUNNEL-VALLEY FORMATION IN VENDSYSSEL, DENMARK

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A large amount of new geophysical and geological data has been collected in the central part of Vendsyssel, Denmark, as a part of a large groundwater investigation. The geophysical Transient ElectroMagnetic (TEM) method has been used to provide a dense data grid and wire-line logs have been performed in order to get detailed point observations. The TEM method measures the variations in the electrical resistivity of the subsurface and a spatial model of resistivity variations has been obtained. The data has led to the delineation of an intricate pattern of buried tunnel valleys, with the individual valleys being typically 5-10 kilometres long, 1 km wide and occasionally eroded to depths of more than 180 m b.s.l. The wire-line logging has provided detailed and continuous physical measurements of the drilled succession both inside and outside the valleys and resistivity logs were used to define the typical resistivity ranges of the individual lithological formations.

The investigation has provided a new insight into the occurrence and the genesis of the valleys of the area and has also provided evidence of glaciotectonically dislocated layers in recessional moraines associated with the valleys. The collected TEM data has been compared with recent results from stratigraphical investigations based on lithological and biostratigraphical analyses along with dating of borehole samples. This has led to an overview of the spatial distribution of the Late Quaternary lithostratigraphical formations and has provided a time frame for the formation of the buried tunnel valleys.

The tunnel valleys are interpreted to have been formed by subglacial meltwater erosion beneath the outermost part of the Late Weichselian ice sheet after the onset of the retreat of the Main advance of the Scandinavian Ice Sheet (c. 20 kyr BP) and before the Lateglacial marine inundation (c. 18 kyr BP). Combining the occurrence of the buried tunnel valleys and the topographical features in the area, four ice-marginal positions related to the recession of the Main advance from northeast and seven ice-marginal positions related to the recession from the following eastern re-advance have been delineated.

Consequently, all the mapped valleys must have been formed within a time interval of about 2000 years, giving only a few hundred years or less for the formation of the buried tunnel valleys at each ice-marginal position.